

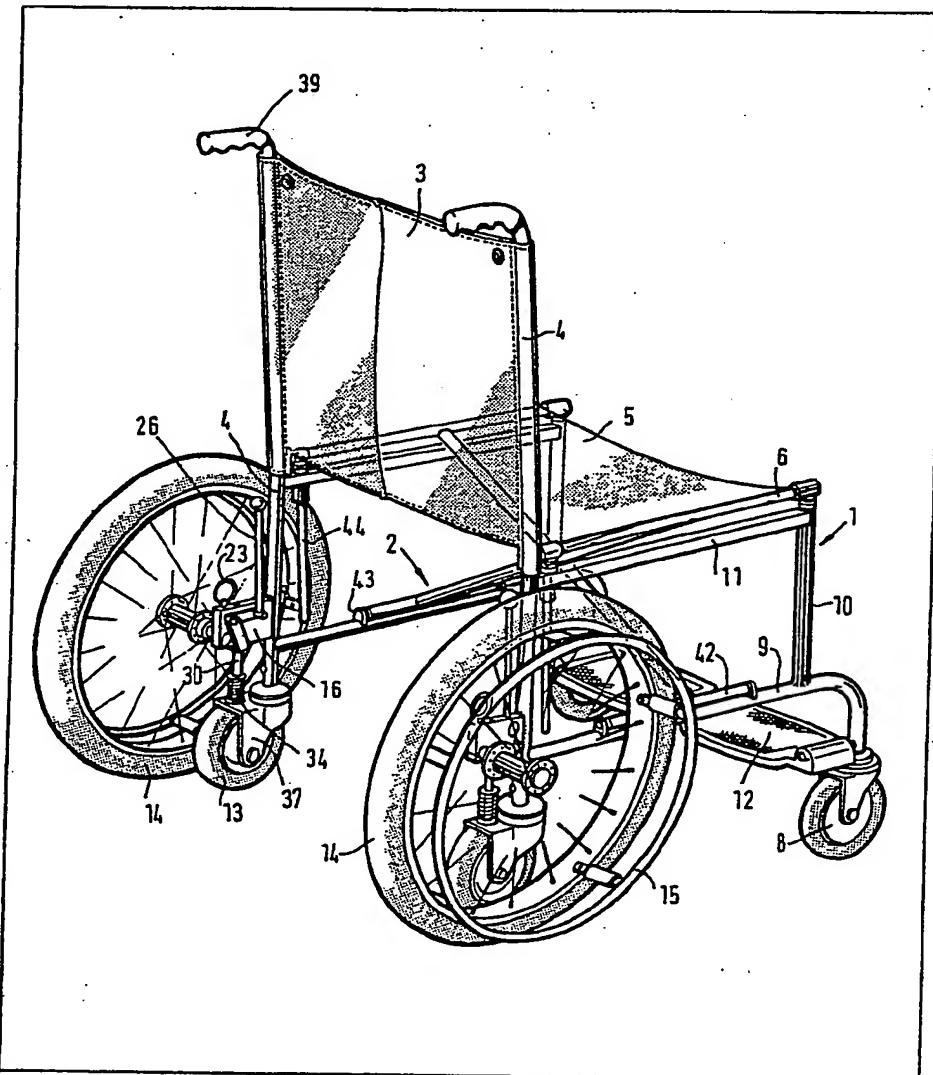
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- (71) Applicant  
The Spastics Society  
(Great Britain),  
12 Park Crescent, London  
W2N 4EQ
- (72) Inventor  
John Michael Singleton
- (74) Agent and/or Address for  
Service  
Audrey E. Knowles,  
624 Pershore Road, Selly  
Park, Birmingham  
B29 7HG

(54) Improvements in foldable wheelchairs

(57) A foldable wheelchair is provided of small and compact folded size for use particularly in travelling where only limited access for wheelchairs is available, e.g. on aeroplanes or trains. The wheelchair has two side frames 1 connected by a foldable linkage 2 operable on lifting member 6 to which the seat panel 5 is fitted with slide rods 44 being guided through cross members 11 of the side frames. The wheelchair includes front castor wheels 8 and removable rear wheels 14 with hand rims 15 for self-

propelling, and to remove the wheels 14 there is a control mechanism operable by a handle 26 to lower rear castor wheels 13 to jack the larger wheels 14 off the ground ready for detachment by lifting a pull ring 23. The control mechanism includes a brake applied to the rear castor wheels on jacking, and the rear castor wheels are biased by springs 34 into the raised position. The wheelchair can be pushed by an attendant when the wheels 14 are removed and the overall width of the wheelchair significantly reduced. The control mechanism can be operated by the wheelchair occupant.



foldable

Removable rear wheels

Rear jockey wheels

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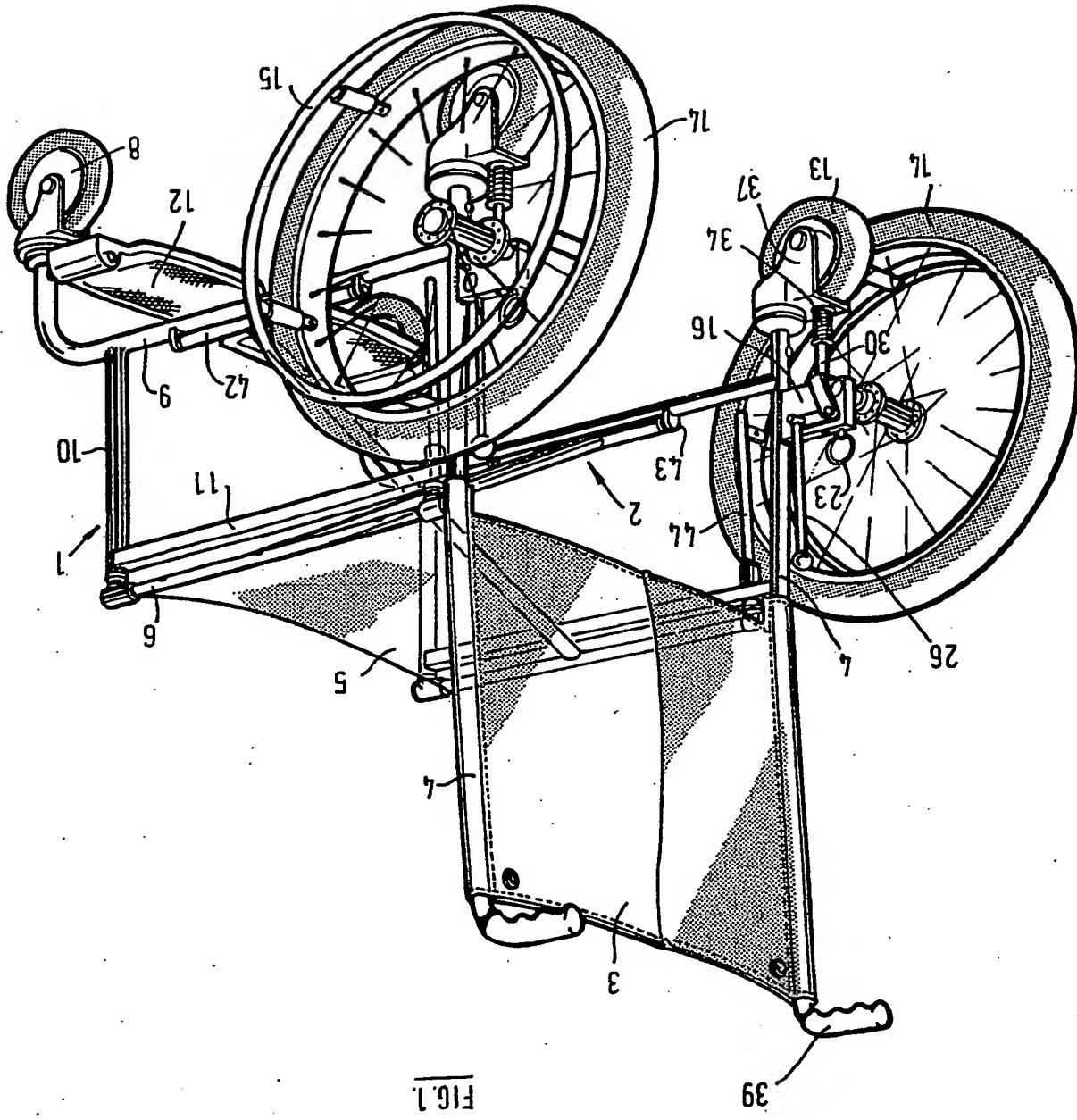
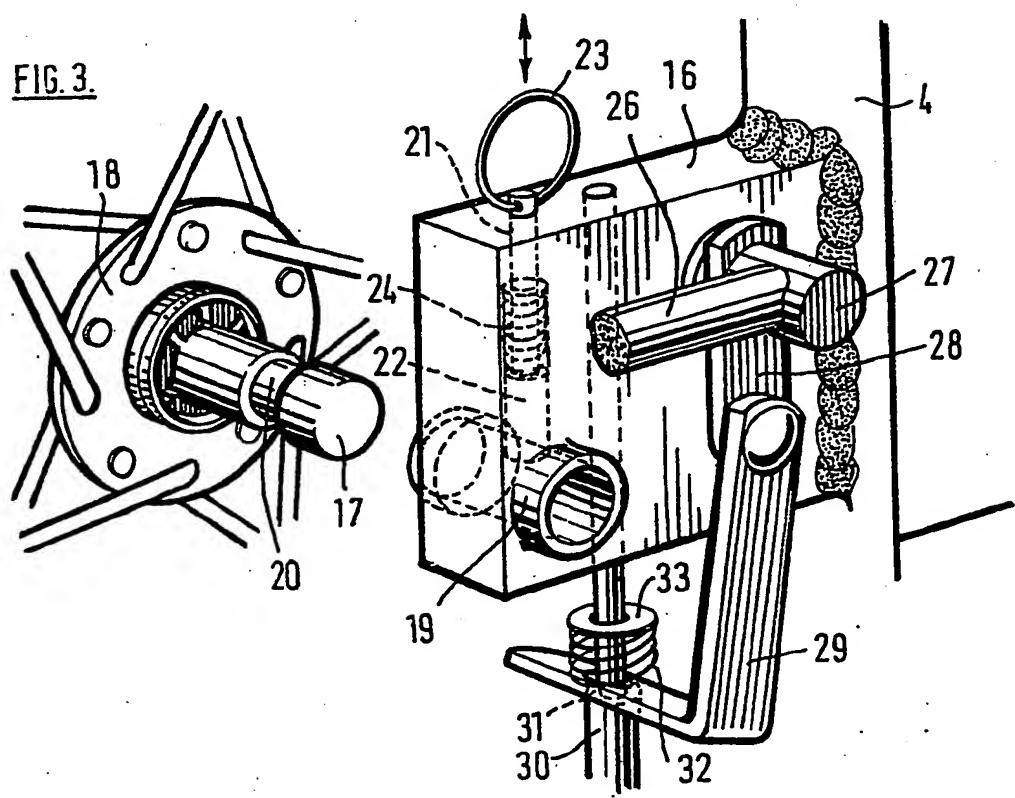
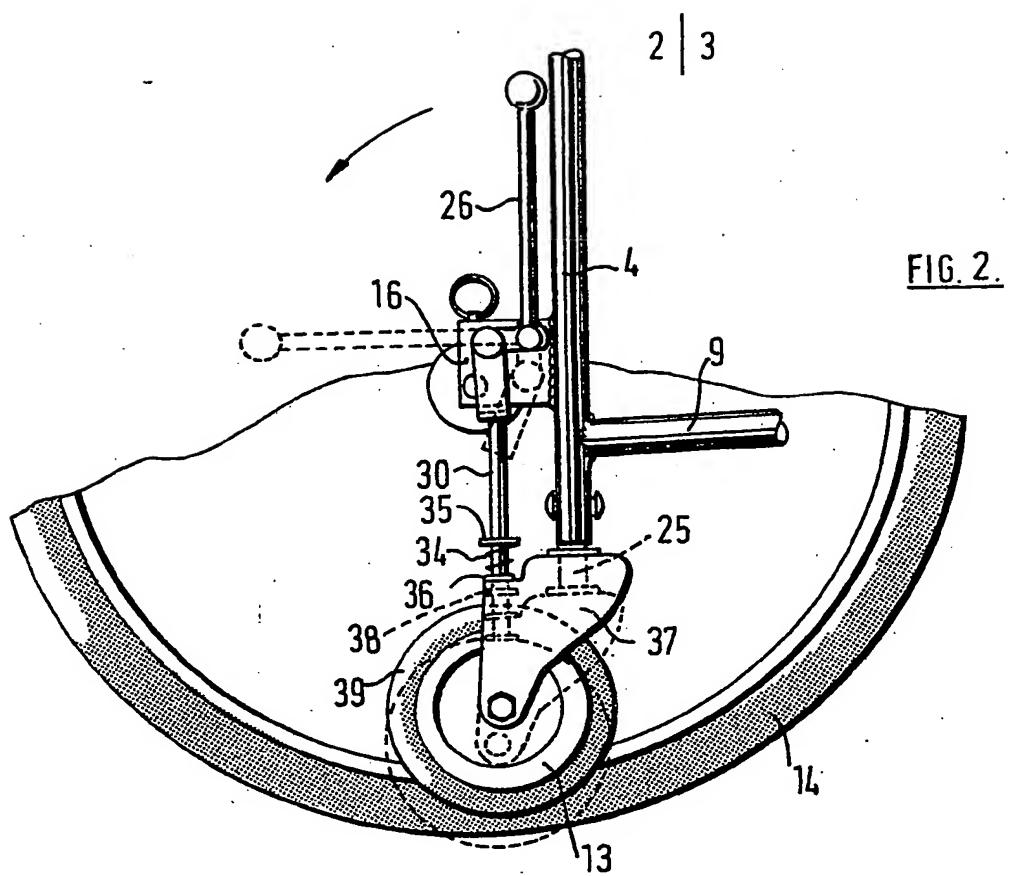


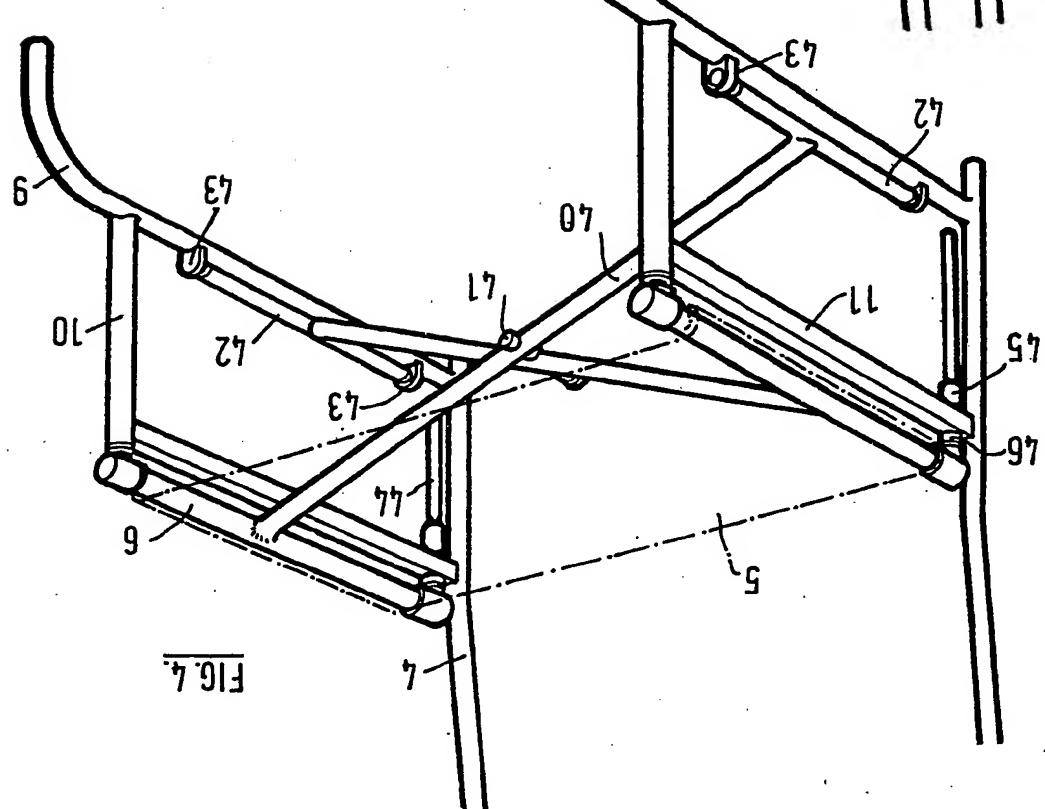
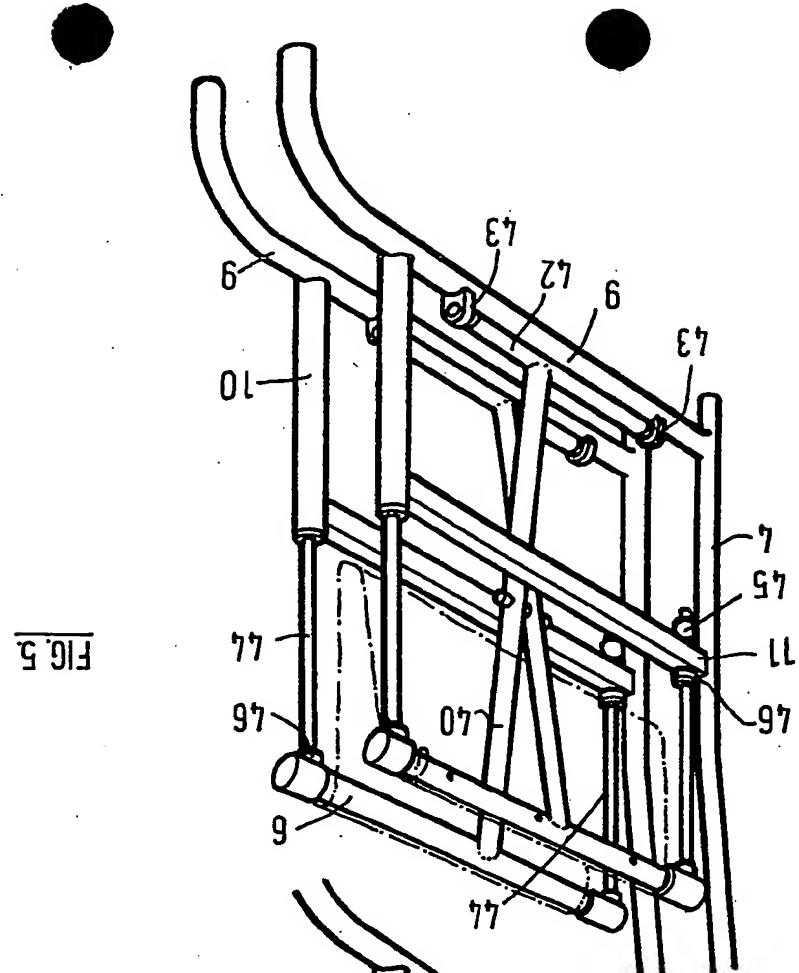
FIG. I.

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**SPECIFICATION****Improvements in foldable wheelchairs**

This invention concerns improvements in foldable wheelchairs and is particularly related to 5 wheelchairs for manual driving by the user or an attendant.

The conventional manual wheelchair for self-propulsion by the user has large front or rear wheels with hand-rims which are used for

10 advancing the wheelchair. The overall width of such wheelchairs is often too great to permit the user manoeuvring in constricted passages or aisles or through narrow openings. A particular problem arises when the user travels on public 15 service transport, such as trains or aircraft.

It is often inappropriate or impossible for the disabled user to be transferred bodily between entrances and/or exits or around the typical constriction which impedes normal wheelchair 20 use. Indeed in many environments, there are no facilities for assisting the wheelchair user and the gangways may be too narrow to carry a disabled person.

It is possible to provide special wheeled 25 transporters or trolleys, but these have limited use as one or more attendants are required and the disabled person has little or no control and is wholly reliant on the attendant(s) whilst in the special transporter.

30 Another problem which is most prevalent in foldable wheelchairs is that even in the foldable state, the dimensions are too wide for convenient stowage, say in a normal luggage hold or compartment.

35 It is an object of this invention to provide an improved foldable wheelchair which overcomes the foregoing problems in a simple and expedient manner of construction.

40 It is an object of this invention to provide an improved foldable wheelchair adapted for self-propelling use or attendant use, and of which the width may be reduced to permit manoeuvring under the control of an attendant whilst still safely transporting the seated user.

45 It is a further object of this invention to provide an improved foldable wheelchair of particularly compact construction having a special form of foldable link.

50 Other objectives of this invention and advantages derived from the invented improved wheelchair will be understood from the description of a preferred embodiment given later herein.

According to this invention we provide a 55 foldable wheelchair comprising two side frame assemblies connected together by a foldable link to which a flexible seat panel is secured extending between the two side frame assemblies, the two side frame assemblies each having a rear upright 60 member to which a flexible back panel is secured also extending between the two side frame assemblies, each side frame assembly mounting a forward castor wheel and rear castor wheel with the rear castor wheel being supported on the

65 respective rear upright member for vertical movement relative thereto by a manually operable control mechanism, and each side frame assembly including a releasable mounting for a further wheel arranged to extend outboard and adjacent to the respective rear castor wheel and adapted for

70 manual self-propulsion of the wheelchair, the arrangement of the pair of rear castor wheels being such that in a raised position the pair of further wheels engage the ground for manual driving of the wheelchair, and by operation of each control mechanism the respective rear castor wheels are lowered to engage the ground whereby the respective further wheels may be removed from their respective mounting with

75 subsequent advancement of the wheelchair being achieved on the forward and rear castor wheels. By this special arrangement, the rear castor wheels are idle during normal use of the wheelchair propelled by the user through the pair of further wheels. On removal of this pair of further wheels outboard of the rear castor wheels, the width of the wheelchair is considerably reduced but without difficulty can still be used to transport the user seated in the wheelchair.

80 Furthermore, with the further wheels removed, the wheelchair may be folded so that the two side frames lie closely adjacent, and due to the absence of the outboard further wheels, in the folded state the wheelchair is of compact narrow dimensions. Additionally, as will be appreciated, the further wheels may be stowed separately in compact form for remounting on the wheelchair when required.

85 Preferably, each control mechanism includes a handle mounted for swinging movement from a first position to a second position with the handle being located relative to the respective rear upright of the frame for accessible actuation by the user seated on the wheelchair.

90 By such an arrangement, the user may actuate the control mechanism personally to either remove or replace the pair of further wheels. This means that the requirement for an attendant is kept to a minimum solely for the special manoeuvre required.

95 Conveniently, the wheelchair includes brake means for preventing rolling movement of the wheelchair. Preferably, such brake means is arranged to act on each respective rear castor wheel. The brake means is associated with each control mechanism and is arranged to apply a frictional restraint on the tyre of the respective rear castor wheel when in the lowered position.

100 By such braking arrangement, when the rear castor wheels are lowered to the position ready, if desired to remove the further pair of wheels, the wheelchair is automatically prevented from rolling movement whilst the steps of removing the further wheels are completed. Furthermore, the 105 brake means may be applied when the wheelchair is in the narrow mode with only the fore and rear castor wheels engaging the ground. This has advantages if the user is to remain in the wheelchair whilst conveyed in a bus, train or



members when the wheelchair is folded or if the footrests are not required.

To the rear of the wheelchair there are two pair of wheels, these being a pair of vertically

5 adjustable castor wheels 13 each mounted on a respective rear upright 4 and a pair of larger wheels 14 for use in self-propulsion of the wheelchair by manual control through hand rims 15. Each wheel 14 is mounted outboard of the 10 associated castor wheel 13 and is detachably supported from a block 16 secured to the lower end of the respective rear upright 4.

As best shown in Figures 2 and 3, the wheel 14 has a stub axle 17 projecting from the hub 18 of 15 the wheel and arranged to be supported in a bearing bush 19 mounted in the block 16. The axle 17 is provided with an annular groove 20 arranged to receive one end of a locating pin 21 which is mounted in a bore 22 in the block and 20 having a pull ring 23 at the other end which is exposed at the top of the block. A spring 24 mounted in the bore 22 serves to urge the pin 21 into engagement with the groove 20 to hold the wheel 14 in rotatable bearing engagement in the 25 block, but on pulling upwards on the ring 23, the pin 21 may be disengaged to release the wheel 14 and permit removal on lateral displacement of the stub axle 17 from the bush 19.

In the self-propelling mode of the wheelchair 30 shown in Figures 1 and 2 the wheels 14 are at an attitude lower than each of the rear castor wheels 13 which are maintained in a raised position (as described later) with each castor shaft 25 being slidably retained within the bottom end of the 35 associated rear upright 4. The castor wheels 13 do not swivel and are only arranged for controlled vertical movement. Each rear castor wheel 13 is arranged to be manually lowered either by the user or an attendant by operation of a control 40 mechanism actuated by swinging a control handle 26 so that the castor wheel 13 is moved into the lowered position shown in broken outline in Figure 2 causing the associated larger wheel 14 to be lifted from the ground out of engagement to 45 permit removal as before described.

Each control mechanism is also mounted on a respective one of the blocks 16. The control handle 26 is fixed to a shaft 27 mounted for limited rotation between two extreme positions in 50 the block 16, and the shaft carries a fixed lug 28 pivotally coupled to a cranked link 29 of which the cranked end is pierced with a control rod 30 extending therethrough. A bore in the block 55 slidably receives one end of the control rod 30 and the link 29 engages a shoulder 31 on the rod with a spring 32 and flange 33 mounted on the rod above the shoulder maintaining the link 29 in such engagement.

The other end of the control rod 30 carries a 60 return spring 34 interposed between a flange 35 mounted on the rod and a collar 36 surrounding a bore through the yoke 37 of the castor wheel. The lower end of the control rod is provided with a foot 38 which, on lowering of the control rod 30, 65 engages the tyre 39 of the castor wheel and

transmits downward movement of the control rod 30 to the castor wheel to lower same against the spring bias of the return spring 34. The engagement of the foot 38 with the tyre also 70 provides a friction brake to prevent rotation of the castor wheel.

As will be appreciated with reference to Figure 2, in the self-propelling mode, on each side of the wheelchair the castor wheel 13 is raised relative 75 to the wheel 4 and maintained in this position by the return spring 34. On swinging movement of the handle 26 into the lowered position, the cranked link 29 is moved downwards by the lug 28 and due to its engagement with the shoulder 80 31 so urges the control rod downwards with the foot 38 being pressed onto the tyre to firstly displace the castor wheel downwardly until it reaches its limit defined by the slideable retention in the rear upright 4. Subsequent final movement 85 of the control handle causes the foot 38 to be forced into hard braking engagement with the tyre so that the wheelchair is maintained stable against rolling movement whilst the user or attendant removes the larger wheels 14 as 90 aforescribed.

After the self-propelling wheels have been removed, the control handles 26 may be raised to release each foot 38 from the respective tyre, in effect "taking off the brake". On release of this 95 95 braking action, the wheelchair is ready for attendant controlled movement by conventional handles 39 on the upper ends of each rear upright.

In this attendant pusher mode, the width of the wheelchair is very small enabling the wheelchair 100 to be manoeuvred through narrow gangways or doors, and the two removed large wheels may be carried separately, even on the user's lap. The control handle(s) may be operated whilst the wheelchair is in this pusher mode to provide 105 braking as required, and the self-propelling wheels may be refitted when desired or convenient.

The wheelchair is foldable in the self-propelling or the attendant pusher mode and will now be described with reference in particular to Figures 1, 110 4 and 5.

The foldable link 2 extends between the two side frames 1 and has two cross struts 40 connected at their centres by a pivot pin 41. Attached to the upper end of each respective strut 115 40 is the transverse side members 6 to which the seat panel 5 is secured. The lower end of each respective strut 40 has a transverse swivel tube 42 rigidly connected thereto and this tube 42 is mounted between trunnion bearings 43 on the 120 respective lower cross member 9 of the side frame 1.

Each end of each side member 6 of the foldable link has a dependent slide rod 44 secured thereto. Each forward slide rod 44 is slidably received 125 within the respective hollow front frame member 10, and each rear slide rod 44 extends through a slide bush 45 mounted in the respective upper cross member 11 adjacent the associated rear upright 4.

130 As shown in Figures 1 and 4, when the

wheelchair is in the extended state, the slide rods 44 depend through their slideways constituted by the members 10 and bushes 45 and the side members 6 each overlie the upper cross members 5 11 of the side frames. Small spacers 46 on the slide rods or slideways provide a small clearance for the material of the seat panel 5.

When the slide rods 44 are in this lowered abutting position it is not possible to fold the linkage 2. Folding movement can only be achieved by lifting each side member 6 to raise the slide rods 44, which movement causes the cross struts 40 to pivot on the pin 41 and the swivel tubes 42 to rotate on their bearings 43 until the fully folded 15 position shown in Figure 5 is achieved.

There is no separate locking or interlocking means associated with the folding link assembly 2 and, when the weight of an occupant is centred on the seat panel 5 it is not possible for the slide rods 20 to lift.

The merits of the wheelchair according to this invention will be understood from the embodiment as just described, but particular attention is drawn to the compact and lightweight 25 construction with the option under the personal control of the user to drive the wheelchair or to remove the larger wheels to significantly reduce the width of the wheelchair. Stability is provided by the relatively long wheel base and the position 30 of the foot rests.

It is envisaged that the releasable means for removing each larger rear wheel may be modified to provide a different type of interlock without departing from the principle hereinbefore 35 described.

Furthermore, the specific construction of the tubular frame elements may be varied and the relative sizes of the castor and self-propelling wheels.

**40 CLAIMS**

1. A foldable wheelchair comprising two side frame assemblies connected together by a foldable link to which a flexible seat panel is secured extending between the two side frame 45 assemblies, the two side frame assemblies each having a rear upright member to which a flexible back panel is secured also extending between the two side frame assemblies, each side frame assembly mounting a forward castor wheel and 50 rear castor wheel with the rear castor wheel being supported on the respective rear upright member for vertical movement relative thereto by a manually operable control mechanism, and each side frame assembly including a releasable 55 mounting for a further wheel arranged to extend outboard and adjacent to the respective rear castor wheel and adapted for manual self-propulsion of the wheelchair, the arrangement of the pair of rear castor wheels being such that in a 60 raised position the pair of further wheels engage the ground for manual driving of the wheelchair, and by operation of each control mechanism the respective rear castor wheels are lowered to engage the ground whereby the respective further

65 wheels may be removed from their respective mounting with subsequent advancement of the wheelchair being achieved on the forward and rear castor wheels.

2. A wheelchair according to claim 1 wherein 70 each control mechanism includes a handle mounted for swinging movement from a first position to a second position with the handle being located relative to the respective rear upright of the frame for accessible actuation by 75 the user seated on the wheelchair.
3. A wheelchair according to claim 2 wherein the wheelchair includes brake means for preventing rolling movement of the wheelchair.
4. A wheelchair according to claim 3 wherein 80 said brake means is arranged to act on each respective rear castor wheel.
5. A wheelchair according to claim 4 wherein said brake means is associated with each control mechanism and is arranged to apply a frictional 85 restraint on the tyre of the respective rear castor wheel when in the lowered position.
6. A wheelchair according to any one of the preceding claims wherein the releasable mounting for each further wheel comprises a sprung loaded 90 pin mounted in a block secured to the respective rear upright frame member and the wheel axle including a stub axle arranged to be mounted in said block and located therein by the pin.
7. A wheelchair according to claim 6 wherein 95 each block mounts the control mechanism.
8. A wheelchair according to claim 7 wherein each rear castor wheel is slidably mounted in the respective rear upright of the side frame and there is a control rod mounted in the block for sliding 100 movement on actuation of the control handle to move the respective rear castor wheel against spring means biasing the said rear castor wheel into the raised position.
9. A wheelchair according to claim 8 wherein 105 the control rod is provided with a foot which on actuation of the control mechanism to lower the associated rear castor wheel engages the tyre of the said castor wheel to thereby provide the braking action.
- 110 10. A wheelchair according to any one of the preceding claims wherein the foldable link of the wheelchair comprises two cross struts extending under the seat panel and pivotally connected at their centres, the upper end of each cross strut 115 having connected thereto a transverse side member to which the seat panel is secured, and each transverse side member being slidably located in the respective side frame of the wheelchair between a lowered position in which 120 the wheelchair is extended and a raised position for folding of the wheelchair.
11. A wheelchair according to claim 10 wherein each said transverse side member is slidably located by dependent slide rods arranged 125 to extend through slideways in the respective side frame of the wheelchair.
12. A wheelchair according to claim 11 wherein there is one slide rod at each opposed end of the transverse side member.

13. A wheelchair according to claim 12  
wherein the lower end of each cross strut is  
connected to the respective wheelchair side frame  
by a swivel tube extending transversely of the  
5 respective strut and mounted in pivot bearings.

14. A wheelchair according to any one of the  
preceding claims wherein the front castor wheels

are mounted for castoring action on the front of  
each side frame, and adjacent to each front castor  
10 when there is a footrest extending transverse of  
the respective side frame for folding movement.

15. A foldable wheelchair substantially as  
hereinbefore described with reference to the  
accompanying drawings.

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